REMARKS

Review and reconsideration on the merits are requested.

Applicants affirm their election without traverse of claims 1-9.

The prior art considered: U.S. Patent 1,414,662 to Morgan (Morgan); Machinery's Handbook (Handbook).

The rejection: claims 1-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan.

The claim amendments:

Claim 1 is rewritten in slightly amended form as claim 22. Since the amendments to the remaining claims were at times, rather substantial, for clarity, claims 1-9 have been canceled and rewritten with the general format (referring to the original claims) being as follows.

Claim 1, rewritten as claim 22, was amended to include the "dendrite" language.

Claim 2, rewritten as claim 23, basically is cast in independent form and includes the limits of dependent claim 9.

There is no new claim corresponding to claim 6.

With respect to original claims 2-5, these have basically been retained depending from claim 22 and a similar set of claims added depending from claim 23.

With respect to the limitation "and at least one part of said spoke portions having a dendrite" included into claim 1, support occurs at page 16, lines 9-14 of the specification.

Applicants now present their traversal of the art rejection.

Since Applicants believe that the features recited in claim 22 and claim 23 establish patentability over the prior art, claims 22 and 23 are principally discussed.

Claim 22 calls for "A light alloy wheel for a vehicle comprising a disc portion comprising a hub portion and a design portion and a rim portion, said design portion having substantially as-die-cast spoke portions having at least partially taper angles of less than 5.0° and at least part of said spoke portions having a dendrite."

Claim 23 calls for "A light alloy wheel for a vehicle integrally cast by a low-pressure casting method comprising a disc portion comprising a hub portion and a design portion and a rim portion, said design portion having substantially as-die-cast spoke portions having at least partially taper angles of less than 5.0°."

Morgan discloses a cast metal wheel comprising spokes U-shaped in cross section having the same U-shaped spokes as those of the present application at first sight (see page 1, left column, lines 12-18 and Figs. 1 and 4).

Machinery Handbook teaches in DIE CASTING section, page 1342, lines 4-5, a general aspect of die casting that:

> "Many die casting are produced by the hot chamber method in which the pressure chamber connected to the die cavity is immersed permanently in the molten metal...." and it further states at lines 36-37 that:
>
> > "Draft allowances on a die casting are usually from 0.5 to 1.5 degrees per side to permit the casting to be pushed off cores or out of the cavity,"

which corresponds to the taper angles defined in the present application (see page 9, line 24-26

of the specification).

Morgan thus teaches a cast metal wheel comprising a hub portion, a rim (felly) portion, and a plurality of spokes U-shaped in cross section (see page 1, left column, lines 33-34), but is silent regarding the cast metal wheel as a light-alloy wheel. Further, Morgan simply teaches spokes having a similarity with the present application in shape, but does not teach or suggest not only any taper angle thereof in detail nor does Morgan contain any technical description on the taper angle per se or on the width and height of the spoke portions.

The disclosure "Draft allowances on a die casting are usually from 0.5 to 1.5 degrees per side to permit the casting to be pushed off cores or out of the cavity." in Machinery Handbook relates to general technology concerning die casting that is carried out using a pressure chamber connected to a die cavity so that the molten metal is forced into the cavity (see Machinery Handbook, page 1342, lines 4-7) and does not relate to technology concerning a wheel comprising a design portion where as-die-cast spoke portions where at least part of the spoke portions have a dendrite as in the present application (see page 16, lines 10-15 of the specification).

General die castings are performed using high metal injection pressures as described in Machinery Handbook, page 1342, lines 30-31. It is well known that in such general die castings, molten metal is injected into a die cavity at a stroke, resulting in a rapid cooling, whereby no dendrite can grow at the spoke portions as defined in the present application (in general die cast products, there is formed a chill phase in the inner layer of about 500μm from the casting surface and a fine equiaxed grain structure inside the chill phase).

Machinery Handbook thus describes a die casting quite different from that of the present

application in casting a light alloy wheel with spoke portions having a DAS (dendrite arm spacing) value in the hub portion smaller than the maximum DAS value in the rim portion, and, accordingly, the "Taper angles" described in Machinery Handbook do not directly relate to casting a light alloy wheel per the present invention.

In more detail, in a low-pressure casting method as is used in the present invention, an alloy melt flows at a low speed into the cavity of a die assembly through a stoke where lower end is immersed in the melt in a melt-holding furnace until the die cavity is filled (see page 18, line 17 to page 19, line 1 and Figs. 10(a)-(c) of the specification). Accordingly, the die temperature should be kept at a high temperature so that the melt spread wholly into the die cavity. As a result, the cooling speed of the melt is low so that a dendritic structure is formed in the solidified alloy. Although die cast products having a dendritic structure are inferior in mechanical strength and cycle speed of casting to general die cast products, they do not have substantial entrained gas in the melts thereof, thereby allowing one to produce the wheels having a sufficient thickness.

In contrast to the low-pressure casting used in the present application, in general die castings, the die temperature is kept comparatively low, so that thermal expansion is low and the clearance among the operational parts of the casting apparatus is reduced, whereby the die can be operated almost horizontally. Thus, it is possible to realize "Taper angles" ranging from 0.5 to 1.5 degrees as recited in Machinery Handbook, on page 1342, lines 12-13. In this regard, it must be noted that, as described in Machinery Handbook, "Porosity," because of the trapping of some air in the molten metal results in a high likelihood of casting defects, general die castings are not

a favorable method for producing aluminum wheels which require high safety or for obtaining aluminum wheels having the dendritic structure as defined in the present application.

Applicants thus respectfully submit that one of ordinary skill in the art referring to Morgan which discloses a cast metal wheel, but does not disclose a light-alloy wheel, and Machinery Handbook, which discloses only general die-casting procedures, which have no specific technical relationship to each other, nor to the present invention, would not be motivated to reach the invention recited either in claim 22 or claim 23, and thus claims 22 and 23 are not obvious over Morgan even if combined with Machinery Handbook.

With respect to the Examiner's position on original claims 3 and 6 as set forth at page 3 of the Action, although original claim 6 has been canceled, Applicants would like to offer the following comments on claims 26 and 27 which correspond to original claim 5.

With respect to claims 26 and 27, patentability is clear from the above discussions concerning claim 22. Claims 26 and 27 call for "The light alloy wheel for a vehicle according to claim 22 [or 23], wherein those having a taper angle of less than 5.0° among said spoke portions have a minimum width of 5 mm or less and a height of 20 mm or more."

Because the design portion of the inventive light alloy wheels herein having substantially as-die-cast spoke portions with small taper angles can be produced without galling by the low-pressure casting method of the present application (see page 17, lines 3-14 and page 27, lines 4-15 of the specification), it is possible to make the width of the spoke portions narrow and also to make the height thereof high as defined in the claims 26 and 27. These unique features of claims 26 and 27 can be seen by comparing Fig. 1 with Fig. 18 in appearance. It must

be emphasized that the unique features which include a "sharp" impression can be obtained by the low-pressure casting method of the present application without using conventional mechanical methods such as forging, cutting, etc. (see page 2, lines 13-28 of the specification).

As a consequence, Applicants submit that one of ordinary skill in the art referring to Morgan and Machinery Handbook, for the reasons earlier discussed, would not be motivated to reach the present invention as recited in claims 26 and 27.

With respect to original claims 7 and 8, reflected in new claims 32-35, Applicants would like to separately discuss the patentability of these claims, taking claims 32 and 34 as representative.

Claim 32 calls for "The light alloy wheel for a vehicle according to claim 22, wherein at least part of said spoke portions have a DAS value of less than 30 μm."

To make the spoke portions narrower necessitates not only making them narrower but also providing sufficient strength in mechanical limits, so that the spoke portions have small cross sections, whereby the cooling speed in the spoke portions must be increased (see page 16, line 15 to page 17, line 2 of the specification). The cooling speed of the spoke portions is high, accompanied by increasing the mechanical strength, making it possible to obtain an integral cast wheel having thin, high-strength spokes.

Thus, claim 32 recites that at least part of the spoke portions have a DAS value of less than 30 μm, which it is not believed has been before recognized as a result-effective parameter nor obtained by conventional mechanical means, where the DAS for the dendritic crystallization provides a standard for judging the cooling speed of an alloy melt.

Claim 34 calls for "The light alloy wheel for a vehicle according to claim 1, wherein the

maximum DAS value of said rim portion is larger than the DAS value of said hub portion."

When the spoke portions are to have small cross sections, the cooling speed in the spoke portions must be increased, so that the cooling speed in the other parts of the wheel naturally changes. Thus, in conventional general die castings, a DAS value in the rim portion has been smaller than the maximum DAS value in the hub portion.

However, per the present invention, by providing a portion of the lower die near the hub portion with an optimum cooling structure, the inequality applied to the DAS values of the rim and hub portion in the conventional general die castings is reversed for the first time (see page 17, lines 3-16 of the specification). Accordingly, the unobvious feature recited is derived from the improvement accompanied with a design portion having as-die-cast spoke portions having a small taper angle less than 5.0°.

Accordingly, for the same basic reasons as earlier recited, Applicants submit that one of ordinary skill in the art referring to Morgan (cast metal wheel, no light-alloy wheel) and Machinery Handbook (conventional die-casting practice), both of which are not only silent regarding any low-pressure casting method, but also any dendritic structure in a cast wheel as disclosed in the present application, would not be motivated to reach the invention recited in claim 32 or claim 33, and thus such claims are not rendered obvious by these references.

With respect to the remaining claims, Applicants rely upon their traversal above.

Withdrawal of the rejection and allowance is requested.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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